

Notice of Allowability

Application No.

10/533,147

Applicant(s)

MAEDA ET AL.

Examiner

SEYED M MALEKZADEH

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☒ This communication is responsive to 07/23/2007.
2. ☒ The allowed claim(s) is/are 1-5, 8 and 9.
3. ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some* c) ☐ None of the:
- ☐ Certified copies of the priority documents have been received.
 - ☐ Certified copies of the priority documents have been received in Application No. _____.
 - ☒ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

* Certified copies not received: _____.

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.
THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.

4. ☐ A SUBSTITUTE OATH OR DECLARATION must be submitted. Note the attached EXAMINER'S AMENDMENT or NOTICE OF INFORMAL PATENT APPLICATION (PTO-152) which gives reason(s) why the oath or declaration is deficient.
5. ☐ CORRECTED DRAWINGS (as "replacement sheets") must be submitted.
- (a) ☐ including changes required by the Notice of Draftsperson's Patent Drawing Review (PTO-948) attached
- 1) ☐ hereto or 2) ☐ to Paper No./Mail Date _____.
- (b) ☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date _____.
- Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).
6. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

Attachment(s)

- | | |
|--|---|
| 1. <input type="checkbox"/> Notice of References Cited (PTO-892) | 5. <input type="checkbox"/> Notice of Informal Patent Application |
| 2. <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 6. <input type="checkbox"/> Interview Summary (PTO-413),
Paper No./Mail Date _____ |
| 3. <input checked="" type="checkbox"/> Information Disclosure Statements (PTO/SB/08),
Paper No./Mail Date <u>06/21/2007</u> | 7. <input checked="" type="checkbox"/> Examiner's Amendment/Comment |
| 4. <input checked="" type="checkbox"/> Examiner's Comment Regarding Requirement for Deposit
of Biological Material | 8. <input checked="" type="checkbox"/> Examiner's Statement of Reasons for Allowance |
| | 9. <input type="checkbox"/> Other _____ |

DETAILED ACTION

EXAMINER'S AMENDMENT

An examiner's amendment to the record appears below. Should the changes and/or additions be unacceptable to applicant, an amendment may be filed as provided by 37 CFR 1.312. To ensure consideration of such an amendment, it MUST be submitted no later than the payment of the issue fee.

Authorization for this examiner's amendment was given to examiner through a telephone interview with Mr. Gerald T. Shekleton on October 11, 2007.

The application has been amended as follows:

Claim 1, line 16, at the end of the claim, period "." has been deleted.

Claim 1, line 16, at the end of the claim, after substrate --, wherein in the silicon crystal production step, controlling the oxygen concentration in the silicon crystal to no more than $12.5 \times 10^{17} \text{ atoms/cm}^3$. --has been inserted.

Claim 9, line 12, at the end of the claim, period "." has been deleted.

Claim 9, line 12, at the end of the claim, after substrate --, wherein in the silicon crystal production step, controlling the oxygen concentration in the silicon crystal to no more than $12.5 \times 10^{17} \text{ atoms/cm}^3$. --has been inserted.

Claims 6-7 and 10 are canceled.

Allowable Subject Matter

Claims 1-5 and 8-9 are allowed.

Claims 6-7 and 10 are cancelled.

The following is an examiner's statement of reasons for allowance:

The prior arts of record fail to teach or suggest a silicon crystal production step of producing a silicon crystal while controlling a concentration of boron in the silicon crystal and a growth condition as defined in the claims of the instant application. The closest prior arts of the record Hoshi et al (US 6,565,822) and Hiroshi et al (JP 2001-039797) fail to teach or suggest a silicon crystal production step of producing a silicon crystal while controlling a concentration of boron in the silicon crystal and a growth condition V/G (where V is a growth rate, and G is a temperature gradient in a crystal axis direction) by using as a boundary condition so as to fall within an epitaxial defect region in which a silicon wafer substrate and an epitaxial growth layer are free of defects and which has the lower limit line at $1 \times 10^{18} \text{ atoms/cm}^3$ and above boron concentration in the silicon crystal wherein the concentration of the oxygen in the silicon crystal in silicon crystal production step is not more than $12.5 \times 10^{17} \text{ atoms/cm}^3$, as disclosed in the independent claim 1. Also Hoshi et al (US 6,565,822) and Hiroshi et al (JP 2001-039797) fail to teach or suggest a silicon crystal production step of producing a silicon crystal while controlling a boron concentration in the silicon crystal and a growth condition V/G (where V is a growth rate, and G is a temperature gradient in a crystal axis direction) so as to fall in an epitaxial defect free region in which void defects occur in a silicon wafer substrate and epitaxial defects that are a cause of the void defects, do

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not appear on an epitaxial growth layer after forming a thin film epitaxial growth layer of less than $2\mu m$ on the silicon wafer substrate where the void defects occur wherein the concentration of the oxygen in the silicon crystal in silicon crystal production step is not more than $12.5 \times 10^{17} \text{ atoms/cm}^3$, as disclosed in the independent claim 9.

Therefore claims 1-5 and 8-9 are deemed allowable.

Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance."

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Seyed Masoud Malekzadeh whose telephone number is 571-272-6215. The examiner can normally be reached on Monday – Friday at 8:30 am – 5:00 pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Yogendra N. Gupta can be reached on (571) 272-1316. The fax number for the organization where this application or proceeding is assigned is 571-272-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published application may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more

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information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

SMM



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